List of highly toxic gases

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Many gases have toxic properties, which are often assessed using the LC50 (median lethal dose) measure. In the United States many of these gases have been assigned an NFPA 704 health rating of 4 (may be lethal) or 3 (may cause serious or permanent injury), and/or exposure limits (TLV, TWA or STEL) determined by the ACGIH professional association. Some, but by no means all, toxic gases are detectable by odor which can serve as a warning. Among the best known toxic gases are carbon monoxide, chlorine, nitrogen dioxide and phosgene.

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Definition

- Toxic: A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million (ppm) but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.[1]
- NFPA 704: Materials that, under emergency conditions, can cause serious or permanent injury are given a Health Hazard rating of 3. Their acute inhalation toxicity corresponds to those vapors or gases having LC_{50} values greater than 1,000 ppm but less than or equal to 3,000 ppm. Materials that, under emergency conditions, can be lethal are given a Health Hazard rating of 4. Their acute inhalation toxicity corresponds to those vapors or gases having LC_{50} values less than or equal to 1,000 ppm.

List

Chemical name	Chemical formula	CAS number	NIOSH IDLH in ppm	LC50 Model	LC50 toxicity in ppm[note 1][2]	Odor warning property	NFPA 704 Health Rating
Arsenic pentafluoride	AsF_5	7784-36-3		Rat	20	inadequate	4
Arsine	AsH_3	7784-42-1	3	Rat	20; ACGIH (2006) TWA-TLV 0.005ppm		4
Bis(trifluoromethyl)peroxide	$C_2F_6O_2$	927-84-4	10	Rat			
Boron tribromide	BBr_3	10294-33-4	50	Rat	380; ACGIH (1990) Ceiling limit 1ppm		3
Boron trichloride	BCl_3	10294-34-5	25	Rat	2541		4
Boron trifluoride	BF_3	7637-07-2	25		OSHA, ACGIH (1962) 1ppm ceiling		4
Bromine	Br_2	7726-95-6	3		ACGIH (1991) STEL-TLV 0.2ppm		3
Bromine chloride	BrCl	13863-41-7		Rat	290		
Bromomethane	CH_3Br	74-83-9		Rat	811.14		3
Carbon monoxide	CO	630-08-0	1,200 (moderately toxic)		ACGIH (1989) TWA TLV 25ppm; NIOSH 35ppm; NIOSH 200ppm Ceiling limit		3
Chlorine	Cl_2	7782-50-5	10		ACGIH (1986) STEL-TLV 1ppm	Odor threshold 1ppm	
Chlorine pentafluoride	ClF_5	13637-63-3					
Chlorine trifluoride	ClF_3	7790-91-2			ACGIH (1979) Ceiling limit 0.1ppm	inadequate	4
Chlorofluorocarbons							
Chloropicrin	CCl_3NO_2	76-06-2			ACGIH (1990) TWA-TLV 0.1ppm		
Cyanogen	C_2N_2	460-19-5		Rat	350; ACGIH (1966) TWA-TLV 10ppm	inadequate	4
Cyanogen chloride	CNCl	506-77-4		Rat	1.2 mg/l/h; ACGIH (1977) ceiling limit	inadequate	4

Chemical name	Chemical formula	CAS number	NIOSH IDLH in ppm	LC50 Model	LC50 toxicity in ppm[note 1][2]	Odor warning property	NFPA 704 Health Rating
					0.3ppm		
Diazomethane	CH_2N_2	334-88-3	2		ACGIH (1970) TWA-TLV 0.2ppm		
Diborane	B_2H_6	19287-45-7		Rat	80; ACGIH (1990) TWA-TLV 0.1ppm	inadequate	4
Dichloroacetylene	C_2Cl_2	7572-29-4		Mouse	45.6		
Dichlorosilane	H_2Cl_2Si	4109-96-0		Rat	314		4
Fluorine	F_2	7782-41-4		Rat	185; ACGIH (1970) STEL-TLV 2ppm	odor threshold 20ppb	
Formaldehyde, gas	CH_2O	50-00-0		Rat	0.66; ACGIH (1987) Ceiling limit 0.3ppm		3
Germane	GeH_4	7782-65-2		Rat	622	inadequate	4
Hexaethyl tetraphosphate	$(C_2H_5O)_6P_4O_7$						
Hydrogen azide	HN_3	7782-79-8					
Hydrogen cyanide	HCN	74-90-8		Rat	40; ACGIH (1991) ceiling limit 4.7ppm	inadequate	4
Hydrogen selenide	H_2Se	7783-07-5	1	Rat	2; ACGIH (1990) TWA-TLV 0.05ppm	inadequate	4
Hydrogen sulfide	H_2S	7783-06-4	100	Rat	712; ACGIH (1990) STEL-TLV 15ppm		4
Hydrogen telluride	H_2Te	7783-09-7					
Nickel tetracarbonyl	$Ni(CO)_4$	13463-39-3			ACGIH (1980) TWA-TLV 0.05ppm	inadequate	4
Nitrogen dioxide	NO_2	10102-44-0				odor threshold 4 ppm	
Osmium tetroxide	OsO_4	20816-12-0		Rat			
Oxygen difluoride	OF_2	7783-41-7		Rat	2.6; ACGIH (1983) ceiling limit 0.05ppm		

Chemical name	Chemical formula	CAS number	NIOSH IDLH in ppm	LC50 Model	LC50 toxicity in ppm[note 1][2]	Odor warning property	NFPA 704 Health Rating
Perchloryl fluoride	$ClFO_3$	7616-94-6		Rat	770; ACGIH (1962) STEL-TLV 6ppm		
Perfluoroisobutylene	C_4F_8	382-21-8		Rat	1.2		
Phosgene	CCl_2O	75-44-5		Rat	5; ACGIH (1992) TWA-TLV 0.1ppm	inadequate	4
Phosphine	PH_3	7803-51-2	50		NIOSH 0.3ppm time weighted average; ACGIH (1992) STEL-TLV 1ppm	inadequate	4
Phosphorus pentafluoride	PF_5	7647-19-0		Rat	260		
Selenium hexafluoride	SeF_6	7783-79-1	2	Rat	50; ACGIH (1992) TWA-TLV 0.05ppm		
Silicon tetrachloride	$SiCl_4$	10026-04-7		Rat	750		
Silicon tetrafluoride	SiF_4	7783-61-1		Rat	450		
Stibine	H_3Sb	7803-52-3	5	Rat	20		4
Disulfur decafluoride	S_2F_{10}	5714-22-7	1		ACGIH (1962) ceiling limit 0.01ppm		4
Sulfur tetrafluoride	SF_4	7783-60-0		Rat	40; ACGIH (1992) ceiling limit 0.1ppm		3
Tellurium hexafluoride	TeF_6	7783-80-4		Rat	25; ACGIH (1992) TWA-TLV 0.02ppm		
Tetraethyl pyrophosphate	$C_8H_{20}O_7P_2$				ACGIH (2006) TWA-TLV 0.01 mg/cubic meter		
Tetraethyl dithiopyrophosphate	$C_8H_{20}O_5P_2S_2$						
Trifluoroacetyl chloride	C_2ClF_3O	354-32-5		Rat	1000		
Tungsten hexafluoride	WF_6	7783-82-6		Rat	217	inadequate	

Notes

1. unless noted as occupational exposure limits. ACGIH Threshold Limit Values are listed with documentation date.

See also

- List of Schedule 1 substances (CWC)
- List of extremely hazardous substances

References

1. "California Fire Code California Code of Regulations,Title 24, Part 9, Chapter 2 - Definitions" (PDF).
2. ACGIH Threshold Limit Values for Chemical Substances and Physical Agents, 2009, ISBN 978-1-882417-95-7.

Sources

- Principles for the Safe Handling and Distribution of Highly Toxic Gases and Mixtures (http://www.asiaiga.org/docs/AIGA%20026_06%20Principles%20for%20safe%20handling%20&%20distribution%20of%20h.pdf) Asia Industrial Gases Association, 2006

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